


# Examining the Relationship Between Supply Chain Management Practices and Production Performance in Indian Handloom Industry

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## ABSTRACT

Clothing is one of the basic needs of human beings and first produced by using handlooms. Cloth can be produced by three ways: using handloom, power loom, and mills. Mill sector falls under organized sector, where as the handloom and power looms fall under unorganized sector. The supply chain in this unorganized sector is different and not given any importance. The main aim of the study is to examine the relationship between supply chain management practices and production performance in Indian handloom industry. Data is collected from the master weavers of Undivided State of Andhra Pradesh and analysed using structural equation modeling. The study found that there is a relationship between the supply chain management practices and production performance.

## KEYWORDS

Handloom Industry, Master Weaver, Production Performance (PPERF), Supply Chain Management, Supply Chain Management Practices (SCMP)

## INTRODUCTION

Clothing is one of the primary needs of mankind. This need led to the invention of handloom, which ultimately developed into industry in the course of time (Narsaiah, 2004).

As per the annual report of Ministry of Textiles (2019), “traditional sectors like handloom, handicrafts and small scale power-loom units are the biggest source of employment for millions of people in rural and semi urban area and also contribute to more than 75% of total textiles production in the country. Handloom weaving provides employment to more than 43 lakh weavers and allied workers. This is the one of the largest employment providers after agriculture. This sector contributes to 15% of the cloth production in the country and also contributes to the export earnings.” The export fabrics are of high value and also caters to the fashion market. According to Haddad & Otayek (2019), the worldwide fashion industry is one of the most competitive sectors of the global economy where a vast number of manufacturers compete without geographic boundaries, producing countless product varieties at an extremely fast pace, and for smaller and smaller profit margins.

According to Lee (2000), the role of manufacturers in the supply chain is critical for the efficiency of the whole supply chain because they have to build a direct relationship with suppliers as well as with customers and handle both interfaces efficiently. Keeping this in view the study is carried out to

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examine the Relationship between Supply Chain Management Practices and Production Performance in Indian Handloom Industry.

“Supply chains have become more complex in today’s global environment primarily due to the shorter product life cycles, increasing demand, and complicated business strategies” (Iqbal& Shalij 2019).

Due to weak supply chain linkages like information flow, transportation problems there exists a production problem which leads to the non-satisfaction of customers. The supply chain integrates all the elements like information flow, transportation which leads to production performance which in turn leads to product quality. Hence the study aims to find out the supply chain management practices followed in handloom sector with special reference to master weavers and to examine the relationship between supply chain management practices and production performance, as he is the one who takes care of all the linkages of supply chain.

La Londe’s study (as cited in Chen & Paulraj, 2004), “The term supply chain management (SCM) was originally introduced by consultants Oliver and Webber in the early 1980s and has subsequently gained tremendous attention”.

## **LITERATURE REVIEW**

As cited by Anilkumar & Sridharan, 2019 (Christopher, 1992) defines supply chain management as “a network of organizations that are involved, through upstream and downstream linkages, in the different processes and activities that produce value in the form of products and services in the hands of the ultimate customer”.

As cited by Kumar & Anbanandam, 2019 (Baker, 2000) the main objective of doing any literature review is to identify the central theme of a topic or subject, with the aim of identifying the previous research and progress of research, as well as the related gaps that remain less discussed in the literature.

### **Supply Chain in Textiles**

Table 1 shows the Literature on Supply Chain in Textiles.

#### **Handloom Supply Chain (HSC)**

The handloom supply chain involves the most important stages of fibre production, yarn production, and fabrication (see Figure 1).

##### ***Stage I: Fibre Production***

The first stage in the handloom supply chain is production of fibre. Fibre is the primary material that is essential to produce any type of fabric. Fibres can be classified in to two types: (i) natural & (ii) manmade or synthetic fibres. Fibre is obtained after undergoing a process called *ginning*.

##### ***Stage II: Yarning/Spinning***

Second stage in handloom supply chain consists of transforming the natural fibres into yarns. Here fibre is spun in the spinning mills where in the mechanical process they are kept in the lengthwise direction and twisted in order to convert into the yarns either single or folded. Yarns are produced in regular and fancy varieties.

##### ***Stage III: Fabric Production***

It is the most important stage. Fabric can be produced by weaving or knitting. Weaving is interlacing the length wise and width wise yarns. This can be done in three production structures in handloom sector namely, Cooperative structure, Master weaver structure and Individual weaver structure.

Table 1. Literature on Supply Chain in Textiles

| Author and Year       | Details   |
|-----------------------|---|
| Kaya & Öztürk, 2014   | Supply chain in textile is described as the chain of the firms being suppliers to each other which is formed in the process from the production of textile production material from cotton to deliver the end product to customers. Supply chain in textile industry consists of a lot of procedures, suppliers, middleman and customers. Knowledge and physical product flow are important in this chain.  |
| Giri & Rai, 2013      | In their study on dynamics of garment supply chain found that the Indian garment industry is facing many supply chain issues like, visibility, lead time, inventory management, collaboration, technology and logistics.  |
| Nema et al., 2013     | Conducted a literature review on the green supply chain management practices in textile & apparel industry.   |
| Berdine, et al., 2008 | Textiles provide major input to the clothing industry, creating vertical linkages between these two industries, forming a supply chain. A supply chain is defined as the network of storage facilities, suppliers, distributors, transporters, retailers, and that participate in the sale, delivery & production of a particular product.  |
| Lam & Postle, 2006    | Have reviewed the concept of supply chain management in textile & apparel supply chain management in Hong Kong. They discussed the strengths & problems faced by the Hong Kong textile & apparel supply chains. They argued that Hong Kong apparel industry is generally not aware of the concept of supply chain management & industrial benchmark for both manufacturing & retailing industries in Hong Kong & the supply chain performance is below the world average. |
| Lee & Kincade, 2003   | Have studied the level of SCM activities & examined the relationship of selected company characteristics for a set of US apparel manufacturer companies & identified six dimensions of SCM namely partnership, operational flexibility, performance measurement, management commitment, information technology, and demand characterization. They advocate that apparel manufacturers have more partnership type relationship with their supply chain members.            |
| Chandra & Kumar, 2000 | Described the application of a supply chain analysis methodology for managing waste due to the inventory-related logistics in a garment supply chain of the US textile industry.  |

### Supply Chain Management Practices (SCMP)

Table 2 shows the Literature on Supply Chain Management Practices.

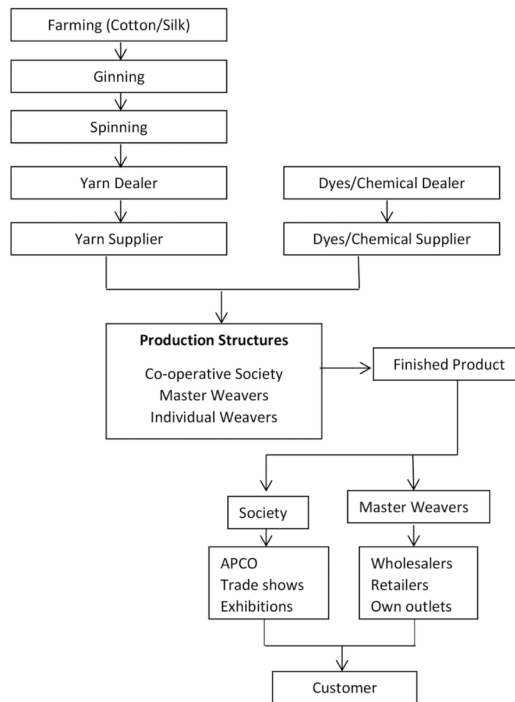
After reviewing and consolidating the literature, four distinctive sub-constructs were selected for measuring SCM Practices (see Table 3). These cover upstream (strategic supplier partnership) and downstream (customer relationship) sides of a supply chain, information flow across a supply chain. Supply chain management practices in the study is operationalized by the four distinct practices are:

1. Strategic Supplier Partnership (**SSP**);
2. Customer Relationship (**CR**);
3. Information Sharing (**IS**); and
4. Information Quality (**IQ**).

### Production Performance (PPERF)

Table 4 shows the Literature on Production Performance.

Figure 1. The supply chain of handloom products



Durability depends on the type of dyes used and the method of processing followed. Usage of poor dyes and chemicals leads to poor fastness to colour, wash, rubbing, and perspiration. Poor colour fastness products on the dye molecules and heavy metal ions may be absorbed into the body through the skin against skin and even damage to health.

Lack of finance is the severest problem followed by the excessiveness of yarn price is perceived to be the second most pressing difficulty.

Production performance in this study is operationalized by Quality, Cost, Flexibility and Delivery. The sub-constructs considered to measure production performance (see Table 5).

## METHODOLOGY

### Research Objective

To examine the relationship between supply chain management practices and production performance in Indian Handloom Industry.

### Research Hypothesis

**H<sub>1</sub>:** There is a significant relation between supply chain management practices and production performance.

### Research Design

The present study employs the *explorative and descriptive* research designs and follows *qualitative and quantitative* research approach (see Figure 2).

Table 2. Supply Chain Management Practices (SCMP)

| Author and Year      | Details   |
|----------------------|---|
| Agus, 2015           | In her study on supply chain management: the influence of SCM on production performance and product quality, found that SCM has a positive & significant effect on production performance, product quality and also provides evidence that the production performance construct partially mediates the linkage between SCM & product quality.   |
| Lotfi et al, 2013    | Found that <i>information sharing</i> in supply chain management, in order to increase the efficiency of the organizational performance in the manufacturing sector.  |
| Sukati et al, 2012   | The results of the study revealed that SCM practices have a statistical significant relationship with supply chain performance.   |
| Agus, 2011           | In a study supply chain management, product quality & business performance conducted in the Malaysian manufacturing industries considered <i>strategic supplier partnership, lean production, quality information exchange between supply chain partners and new technology &amp; innovation</i> for supply chain management practices. The results reveal that strategic supplier partnership & postponement concept is of primary importance and exhibit significant effects on product quality & business performance  |
| Arawati, 2011        | Study reveals that SCM has significant correlations with supply chain flexibility and business performance.   |
| Sukati et al., 2011  | In their study considered <i>strategic supplier partnership, customer relationship &amp; information sharing</i> as important determinants of supply chain management practices conducted in Malaysian manufacturing industry. The results revealed that the information sharing has the determinant effect of supply chain responsiveness, followed by customer relationship and strategic supplier partnership respectively.  |
| Agus, 2008           | Strategic supplier partnership and implementation have significant associations with product quality performance & business performance   |
| Berdine et al., 2008 | In their study analysis of supply chain strategies used by the United State textile and apparel industries, found that <i>quality, cost, reliability, lead-time, and flexibility</i> are important in the supply chain strategies.  |
| Li et al., 2006      | “SCM practices have been defined as the set of activities undertaken by an organization to promote effective management of its supply chain”.   |
|                      | Conceptualized SCM as a five-dimensional construct. These five dimensions are strategic supplier partnership, customer relationship, information sharing, quality of information sharing & postponement.  |
|                      | In their study on the impact of supply chain management practices on competitive advantage and organizational performance, identified five distinctive dimensions of SCM practices namely, <i>strategic supplier partnership, customer relationship, level of information sharing, quality of information sharing, &amp; postponement</i> . And the results indicate that the higher levels of SCM practices lead to enhanced competitive advantage and improved organizational performance.  |
| Li et al., 2005      | In their study on development & validation of a measurement instrument for studying the supply chain management practices, identified six distinctive dimensions of SCM practices namely, <i>strategic supplier partnership, customer relationship, information sharing, information quality, internal lean practices &amp; postponement</i> . These six constructs cover upstream (strategic supplier partnership) & downstream (customer relationship) sides of a supply chain, information flow across a supply chain (information sharing & information quality), and internal supply chain processes (internal lean practices & postponement). |
| Monczka et al, 1998  | Considered <i>information sharing and information quality &amp; participation</i> are the determinants of strategic supplier alliance.  |

### Exploratory Study

Explorative research was conducted to formulate the problem, develop hypothesis and to provide insights & understanding the problem. The study has used secondary data, discussion with the experts and pilot study to explore the problem and identifying the underlying variables.

**Table 3. List of sub-constructs for SCM Practices**

| Sub-Construct                        | Definition  | Contributors   |
|--------------------------------------|---|--|
| Strategic Supplier Partnership (SSP) | The long-term relationship between the organization and its suppliers. It is designed to leverage the strategic and operational capabilities of individual participating organizations to help them achieve significant ongoing benefits. | Li et. al., (2005, 2006), Tan et. al., (2002), Stuart FI (1997), Gunasekaran et. al., (2001), Monczka et. al., (1998), Thatte (2007), Lamming (1996), Inda Sukati et. al., (2011a, 2012)       |
| Customer Relationship (CR)           | The entire array of practices that are employed for the purpose of managing customer complaints, building long-term relationships with customers, and improving customer satisfaction.  | Li et. al., (2005, 2006), Moberg et. al., (2002), Tan et. al., (2002), Claycomb et. al., (1999), Day GS (2000), Magretta J. (1998), Vickey et. al., (2003), Inda Sukati et. al., (2011a, 2012) |
| Information Sharing (IS)             | The extent to which critical and proprietary information is communicated to one's supply chain partner.   | Li et. al., (2005, 2006), Monczka et. al., (1998), Mentzer et. al., (2000), Inda Sukati et. al., (2011a, 2012)   |
| Information Quality (IQ)             | The accuracy, timeliness, adequacy and credibility of information exchanged.  | Li et. al., (2005, 2006), Inda Sukati et. al., (2011a, 2012)   |

Compiled from Li et. al., (2006) and Abdelsalam & Fahmy (2009)

### *Descriptive Study*

The findings of the exploratory research are considered as input for the descriptive research. Descriptive study is used to test the hypothesis which were formulated by exploratory study, and to determine the relationship between the factors identified.

### *Qualitative Approach*

Qualitative approach enables to understand the industry and was carried out by interviewing the field experts & the master weavers to get insights of the items which were generated in the study.

### *Quantitative Approach*

Quantitative approach enables to test the model developed during the process. The study evaluates the inter-relationships among the supply chain management practices and production performance. In this study, the research explored and conceptualized critical dimensions of supply chain management practices (SCMP), and production performance (PPERF).

### **Population of the Study**

The present study focuses on the relationship between handloom supply chain management practices and production performance. Hence, the master weavers are considered as the population of the study.

### *Reason for Selecting Master Weavers*

The study considered Master weavers based on the supply chain management practices & the production performance which is discussed below.

Since Government records are the main sources of data on rural industry in India, and in the case of handloom the government has always focused on the co-operative sector. All the data that is available is related to handloom co-operatives hence, it was of less use for this study. The selection

Table 4. Production Performance (PPERF)

| Author and Year   | Details   |
|---|---|
| Muhammad Babar & Muhammad Bilal, 2012   | Have considered sourcing, quality, planning & on-time delivery to analyse the overall performance of supply chain management fashion industry of Pakistan. The items considered for quality are availability, quality of raw material, imported raw material, worker's skill, compensation comparison, worker's efficiency, focusing on product design and quality control. The study found that quality is significantly correlated to the dependent variable supply chain management.   |
| Arawati, 2011   | Considered volume flexibility and new product flexibility for measuring the supply chain flexibility in Malaysian manufacturing companies.  |
| Pal & Torstensson, 2011   | The performance of any organization is measured generally in terms of its economic viability (profit-ratio or growth rate). Competitive priorities, like cost, quality, price, delivery performance (speed), and flexibility, etc. are also considerable measurement characteristics to determine organizational performance. Product quality was considered to be the most important success factor for organizations. The surveyed firms also prioritized the high flexibility in product designing & Supply Chain Low lead times and responsiveness. |
| Cai et al., 2009  | Considered flexibility supply chain responsiveness, procurement flexibility, logistics flexibility, manufacturing flexibility, delivery flexibility, new products flexibility & Information systems flexibility as production performance measures.   |
| Ramamurthy, 2009  | The three aims of the performance of the production & operations management are effectiveness, efficiency, and customer satisfaction. Efficiency and effectiveness are measured by cost, quality, durability, dependability and reliability. Durability & dependability are the two factors that often determine the quality. Durability is the length of active life of the product under given working conditions and is associated with the relation of good material  |
| Robb et al., 2008   | Considered product reliability, after-sale service, delivery dependability, consistent quality, low production cost, production time, product durability, new products, delivery time, new product development time, volume flexibility and product mix flexibility as operations performance measurements.   |
| Aramyan et al., 2007  | Considered flexibility in terms of Volume flexibility, delivery flexibility, product quality & reliability.   |
| Hallgren, 2007  | "It is difficult to fairly assess manufacturing performance".<br>Dimensions used conveniently coincide with the common set of competitive priorities, i.e. quality, delivery, flexibility & cost performance. Important to acknowledge is that every dimension, to some extent is vital for all operations, which one is the most important is just a matter of competitive positioning.  |
| Tiwari, 2005  | Rolls-Royce's key metrics for operational performance are Quality, Cost & Delivery. The operational objectives for a supplier are customer response oriented (quality & on-time delivery), and also efficiency oriented (product costs & labour productivity). Quality is an important factor for choosing a supplier non-cost factors include on-time delivery, technological capabilities & flexible production capacity.   |
| Chen & Paulraj, 2004  | In their study used <i>quality, cost, volume flexibility and on-time delivery</i> for measuring operational performance.  |
| Gunasekaran. et al., 2004   | Considered <i>percentage of defects/damages, range of products, on-time delivery</i> for measuring production performance in UK companies.  |
| Boyer & Lewis, 2002; Schroeder et al., 2002; Shah, R. & Ward, 2003; Flynn & Flynn, 2004 | Financial measures, like profitability and ROI etc. are usually plant level measures that are subject to many factors outside the scope of manufacturing operations. An attempt to isolate the performance of the operations function is to utilize measures where the management of operations play an integral part, i.e. operational performance measures.   |
| Chan & Qi, 2003   | In his study considered delivery cost, delivery reliability: timeliness, error-free, and delivery flexibility as performance measures.  |
| Singh et al., 2003  | In their study modelling supply chain performance of organized garment retailing conducted in north India considered four metrics namely; <i>inventory metrics, customer metrics, stake holders' metrics and flexibility metrics</i> (includes volume flexibility, delivery flexibility, and operation flexibility) as key performance indicators.  |
| Beamon, 1999  | In his study considered <i>cost, on-time delivery and flexibility</i> (volume flexibility, delivery flexibility, new product flexibility & mix flexibility) for measuring supply chain performance.   |
| Shin, H. et al, 2000  | Volume flexibility is considered in measuring the buyer (manufacturer) performance.<br>Delivery reliability and lead-time are considered in measuring the buyer (manufacturer) performance.   |
| Bagchi, 1996  | Determined the metrics of a supply chain system to be used in comparing the competitiveness of selected companies & placed each of the 28 metrics in one of the following four categories: <i>Quality, Cost, Time &amp; Diagnostic Measure</i> .  |
| Neely, 1995   | Manufacturing performance is measured in terms of flexibility which includes volume flexibility, mix flexibility & product flexibility. The quality-based measures of performance have focused on issues for instance the <i>number of defects and the cost of quality</i> .  |
| Stewart, 1995   | Proposed that the metrics & measures are discussed in the context of the following supply chain activities/processes: <i>plan, source, make/assemble and delivery/customer</i> .  |
| Leong et al, 1990   | Dimensions of manufacturing performance can be defined in terms of <i>quality, delivery speed, delivery reliability, cost, &amp; flexibility</i> .  |
| Mondal, 1989  | Distribution of yarn in the handloom sector is vitally important for handloom production. In fact, raw materials account for the overwhelming proportion, about 75 per cent, of the total variable cost of the handloom enterprises, of which yarn alone constitutes more than 66 per cent. The growth and development of handloom industry is critically dependent upon the adequate and steady supply of raw materials, especially yarn   |

Table 5. List of sub-constructs for production performance

| Sub-        | Contributors   |
|-------------|--|
| Quality     | A.Gunasekaran et al. (2004); Muhammad Babar & Muhammad Bilal (2012); Pal., R & Torstensson., H. (2011); Bagchi (1996); Porter (1980); Treacy and Wiersema (1993); Tiwari, M. (2005); Neely (1995); H. Shin et al., (2000); Garvin (1987) |
| Flexibility | Aramyan <i>et al.</i> (2007); Robb <i>et al.</i> (2008); Pal., R & Torstensson., H. (2011); Porter (1980); Treacy and Wiersema(1993), Neely (1995); H. Shin et al., (2000)   |
| Cost        | Adul Hye Mondal (1989); Vinayan, S., (2001); Bagchi (1996); Pal., R & Torstensson., H. (2011); A.Aggarwal; Tiwari, M. (2005); Neely (1995)   |
| Delivery    | Robb <i>et al.</i> (2008); Porter (1980); Treacy and Wiersema (1993); Tiwari, M. (2005); Stewart (1995); Neely (1995); H. Shin et al., (2000)  |

Figure 2. Gives an idea of the research design used for the study



is done on the basis of previous studies and the supply chains for different production structures are shown in Figures 3, 4 and 5.

An *independent weaver* is the one who possess the instruments of production, purchase raw materials, i e, yarn, and dyes, from the market & produce the cloth with family labour and sell the product either in the local village market or to the local cloth merchant. There are not many stages involved in this chain; hence, the study is not considered this production structure (see Figure 3).

In *Cooperative production structure*, the raw material is provided to the weavers and the finished product will be returned to the society itself. The raw material procurement will be done by the APEX organization. Here the society, as well as the weaver, is not directly involved in procuring raw material and marketing the finished product (see Figure 4).

Figure 3. The production structure of Independent weaver



Basically the master weaver is the persons who is involved in the entire chain like, procurement of raw material (interaction with the suppliers and financial aspects), providing the raw material to the weavers to weave (involved in human relation issues) and marketing the finished product (interaction with the customers and financial aspects). All these three steps include the information flow, material flow and monetary flow in between the stake holders involved (see Figure 5).

The master weavers provide employment to the weavers on wage basis. This will be of two types/categories. In the first type, the weaver will have an own loom and operate from his home and in second type the weavers will not have a loom, they go to the sheds where the master weaver provides with the loom and the raw material.



Figure 4. The production structure of Weaver working with Co-operative Society

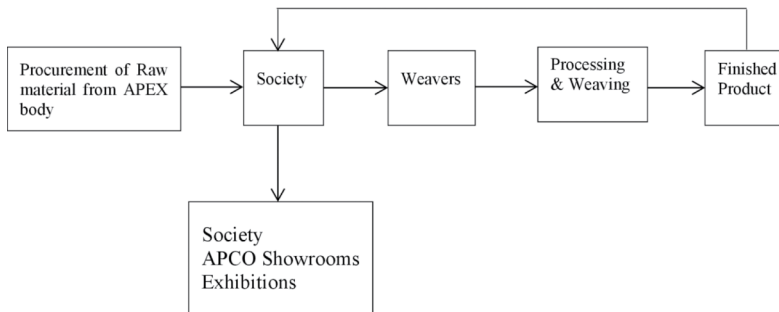
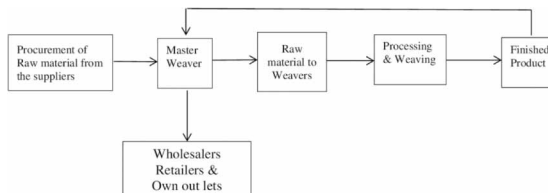


Figure 5. The production structure of Master weaver



## Sampling Technique

In case of the handlooms, the government has always focused on the co-operative sector hence, all the data that is available is connected to handloom co-operatives and therefore the data was of little use for this study (Bhagavatula, 2009). Since there is no secondary data on master weavers (Dev et al., 2008), the study chose *non-probability sampling* technique such as *purposive sampling*.

### Sample Size and Justification

Total 365 valid sample was collected using non-probability purposive sampling method from four select districts located in undivided state of Andhra Pradesh:

1. The study followed the concept of “Five subjects for one variable” as suggested by Hair et al., (2008) to determine the total number of subjects in the sample. As the study identified 48 items, the required sample size should be 240 ( $48 * 5 = 240$ ) for master weavers whereas the valid sample size is 365. Structural Equation Modeling is used to analyse the data, the size of the sample should be large enough to assess the model fit indices (Hair et al., 2010). As recommended by Kelloway (1998) minimum of 200 subjects required to perform structural equation modelling.

Seidler (as cited in Tongco, 2007) has studied different sample sizes of informants selected purposively and found that at least five informants were needed for the data to be reliable.

2. Justification from other studies in the same field.

Bhagavatula (2009), in his study Weaving Social Networks - Performance of small rural firms in India as an outcome of entrepreneurs’ social and human capital the sample size taken for the study is 132.

Dev et al., (2008), in their study on Economics of Handloom Weaving: A Field Study in Andhra Pradesh has studied three production structures. Under master weaver the sample size was 24.

The studies discussed in the literature also considered 195 – 250 manufacturing firms and the data were collected from the managers of the firms.

### Selection of Districts and Justification

Table 6 shows the previous studies for selecting the particular districts.

After going through the previous studies (see Table 6), discussion with the field experts and the persons who are handloom activists, this study has chosen the *four* districts namely; *Nalgonda, Guntur, Prakasam and Krishna* which are having the *concentration of Handloom weaving*.

## DATA ANALYSIS AND RESULTS

The data was collected using both primary and secondary data. And were analysed using statistical packages such as MS Excel, IBM-Statistical Package for Social Sciences version 21 for windows (SPSS-21) and Analysis of Moment Structures (Amos version 21). Descriptive statistics, correlation, factor analysis (both exploratory and confirmatory), structural equation modelling (SEM) were included in the methods of data analysis.

### Demographic Analysis

The demographic analysis of the 365 respondents are presented below.

53.2% of them are members of the society (some of them started working with society as a weaver slowly converted into master weavers) and balance 46.8% of them are non-members of society.

Most of respondents were in the age group of 35 to 44 years (45.2%) followed by 45 to 54 years (34.8%), 55 to 64 years (11.8%), and 25 to 34 years (7.4%). The lowest age group of respondents was above 65 years (0.8%).

Table 6. Selection of Districts based on the Previous Studies (Justification)

| S.No. | Author and Year   | Study  | Select Districts   |
|-------|---|--|--|
| 1     | Mukund,K & B.Syama Sundari, B., 2001                    | Traditional Industry in the New Market Economy - The Cotton Handlooms of Andhra Pradesh  | Nalgonda, Krishna, Prakasam, Guntur, Kurnool, Srikakulam, E.Godavari, Nellore, Kadapa, & Mahaboobnagar |
| 2     | Niranjana, S. & Vinayan, S., 2001                       | Report on Growth and Prospects of the Handloom Industry  | Nalgonda, Krishna, Prakasam, Guntur, Kurnool, & Warangal   |
| 3     | Dev, S. M., Galab, S., Reddy, P. P., & Vinayan, S, 2008 | Economics of Handloom Weaving: A Field Study in Andhra Pradesh   | Nalgonda, Krishna, Prakasam, Guntur, Kadapa, Vizianagaram, Chittoor, Karimnagar & Medak                |
| 4     | Bhagavatula, S., 2009 & 2010                            | Weaving Social Networks. Performance of small rural firms in India as an outcome of entrepreneurs' social and human capital. The working of entrepreneurs in a competitive low technology industry: The case of master weavers in the handloom industry. | Nalgonda, Prakasam, Guntur, Mahaboobnagar & Kakinada   |

Majority of the respondents fall below SSC in the educational qualification (57.3%), followed by SSC (21.1%), illiterate (9.6%), intermediate (6.6%), graduation (4.7%), professional course (0.5%) and lastly post-graduation (0.3%).

Majority of the respondents 48.5% have 14 to 23 years of experience in this field, followed by 4 to 13 years (29%), 24 to 33 years (15.6%), 34 to 43 years (5.2%), 44 to 53 years (1.4%) and 54 to 63 years (0.3%).

Majority of the respondents operate 1 to 20 looms (71.2%) followed by 21 to 40 looms (20.5%), 41 to 60 looms (7.7%) and 81-100 looms (0.5%).

Majority of them produce cotton sarees (32.9%), cotton & silk sarees, cotton sarees & yardage (or dress material) 18.6% each, 14% of them produce silk sarees and 6.6% of them produce bed sheets.

All of them sell their products using different marketing channels. Majority of them sell to trader (41.4%), followed by trader & retailer (14.8%) and trader, retailer & own outlet (12.9%).

The final results of Exploratory Factor Analysis for SCMP are shown in Table 7.

### **Model Fit Summary for SCMP**

The study conducted the initial assessment of model summary. The overall  $\chi^2$ -value is 379.42 with 182 degrees of freedom at the probability level of 0.001. It can be observed that the minimum fit indices are achieved (see Table 8). This indicates that AMOS was successful in estimating all model parameters, thereby resulting in a convergent solution. Hence, the Supply Chain Management Practices is found to be fit.

The model fit summary indicates the overall fit and the result showed that the measurement model is reliable and valid for further analysis.

### **Validity for SCMP**

This section exclusively exhibits the validity analysis of the measurement scale for supply chain management practices. Content validity, convergent validity, discriminant validity, construct validity and predictive validity analysis (see Table 9 and Table 10).

Final results of Exploratory Factor Analysis for PPERF (see Table 11).

### **Model Fit Summary for PPERF**

The study conducted the initial assessment of model summary. The overall  $\chi^2$ -value is 181.046 with 69 degrees of freedom at the probability level of 0.001. It can be observed that the minimum fit indices are achieved (see Table 12). This shows that AMOS was successful in assessing all model parameters, thereby resulting in a convergent solution. Hence, the Production Performance is found to be fit.

The model fit summary shows the overall fit and the result showed that the measurement model is reliable and valid for further analysis.

### **Validity for PPERF**

This section absolutely exhibits the validity analysis of the measurement scale for production performance. Content validity, convergent validity, discriminant validity, & construct validity analysis (see Table 13 and Table 14).

### **Hypothesis Testing**

The hypothesis was tested using AMOS. The independent and dependent variables for this hypothesis are supply chain management practices & production performance respectively. The result of the structural equation modeling indicates that the path from SCMP to PPERF has a moderate of 0.035. Hence, there is a significant impact of supply chain management practices on production performance. And is in line with Li et al. (2006), Agus (2011,2015).

The structural model for the SCMP and PPERF (see Figure 6) shows the good fit indices and the estimate is significant at 0.001 level (see Tables 15 and Table 16).

Table 7. Consolidated result (summary) of exploratory factor analysis for SCMP

| Variable        |   | Factor 1 | Factor 2 | Factor 3 | Factor 4 |
|-----------------|---|----------|----------|----------|----------|
| <b>Factor 1</b> | <b>Strategic Supplier Partnership (SSP)</b>   |          |          |          |          |
| SSP1            | I consider Quality as first criterion in selecting suppliers                          | 0.831    |          |          |          |
| SSP2            | I include my key suppliers in our planning and goal-setting activities                | 0.803    |          |          |          |
| SSP3            | I believe in long term relationships with the suppliers                               | 0.836    |          |          |          |
| SSP4            | I emphasize on high quality suppliers   | 0.829    |          |          |          |
| SSP5            | I give importance to delivery schedule  | 0.808    |          |          |          |
| SSP6            | I actively involve my key suppliers in new product development processes              | 0.808    |          |          |          |
| <b>Factor 2</b> | <b>Customer Relationship (CR)</b>   |          |          |          |          |
| CR1             | I frequently interact with customers to set the standards                             |          | 0.896    |          |          |
| CR2             | I frequently measure customer satisfaction  |          | 0.943    |          |          |
| CR3             | I frequently determine future customer expectations                                   |          | 0.949    |          |          |
| CR4             | I facilitate customer's ability to seek assistance from us                            |          | 0.815    |          |          |
| CR5             | I periodically evaluate the importance of our relationship with my customers          |          | 0.879    |          |          |
| <b>Factor 3</b> | <b>Information Sharing (IS)</b>   |          |          |          |          |
| IS1             | I inform my weavers in advance of changing needs                                      |          |          | 0.834    |          |
| IS2             | My weavers share proprietary information with me                                      |          |          | 0.816    |          |
| IS3             | My weavers keep me fully informed about issues that affect my business                |          |          | 0.688    |          |
| IS4             | My weavers share the knowledge of core production that effect the business            |          |          | 0.801    |          |
| IS5             | Me & my weavers exchange information that helps in establishment of business planning |          |          | 0.798    |          |
| IS6             | Me & my weavers keep each other informed about the changes that effect the production |          |          | 0.762    |          |
| <b>Factor 4</b> | <b>Information Quality (IQ)</b>   |          |          |          |          |
| IQ1             | I share information in time with weavers  |          |          |          | 0.782    |
| IQ2             | I share accurate information with weavers   |          |          |          | 0.884    |
| IQ3             | I share complete information with weavers   |          |          |          | 0.797    |
| IQ4             | I share adequate information with weavers   |          |          |          | 0.751    |

## CONCLUSION

This study highlights the relationship between the supply chain management practices and production performance. The results show that supply chain management practices have significant relation with production performance. Supply chain management plays a very important role in manufacturing sector. As per the analysis carried out, master weavers should focus more on SCM practices to improve their production performance (Anumala, 2017).

**Table 8. Model fit summary for SCMP**

|          |     | Absolute fit indices |       |       | Incremental fit indices |       |       |       | Parsimony fit indices |       |
|----------|-----|----------------------|-------|-------|-------------------------|-------|-------|-------|-----------------------|-------|
| $\chi^2$ | df  | $\chi^2/df$          | GFI   | RMSEA | NFI                     | TLI   | CFI   | RFI   | AGFI                  | PNFI  |
| 379.42   | 182 | 2.085                | 0.909 | 0.055 | 0.922                   | 0.951 | 0.958 | 0.910 | 0.885                 | 0.799 |

Note:  $\chi^2$  – chi-square; df-degrees of freedom, GFI-Goodness of fit; RMSEA-Root mean square error of approximation; NFI-Normed fit index; CFI-Comparative fit index; RFI-Relative fit index; TLI-Tucker-Lewis index; AGFI-Adjusted goodness of fit; & PNFI-Parsimonious normed fit index.

**Table 9. Reliability of SCMP**

| Factor  | EFA Loading |  | CFA Loading |  | AVE (>0.5) |  | CR' (>0.7) |  |  |  |
|---|-------------|--|-------------|--|------------|--|------------|--|--|--|
| Strategic Supplier Partnership (SSP) (Cronbach's alpha $\alpha = 0.902$ ) |             |  |             |  |            |  |            |  |  |  |
| SSP1  | 0.831       |  | 0.795       |  |            |  |            |  |  |  |
| SSP2  | 0.803       |  | 0.743       |  |            |  |            |  |  |  |
| SSP3  | 0.836       |  | 0.809       |  | 0.608      |  | 0.903      |  |  |  |
| SSP4  | 0.829       |  | 0.796       |  |            |  |            |  |  |  |
| SSP5  | 0.808       |  | 0.758       |  |            |  |            |  |  |  |
| SSP6  | 0.808       |  | 0.775       |  |            |  |            |  |  |  |
| Customer Relationship (CR) (Cronbach's alpha $\alpha = 0.938$ )           |             |  |             |  |            |  |            |  |  |  |
| CR1   | 0.896       |  | 0.862       |  |            |  |            |  |  |  |
| CR2   | 0.943       |  | 0.941       |  |            |  |            |  |  |  |
| CR3   | 0.949       |  | 0.945       |  | 0.533      |  | 0.810      |  |  |  |
| CR4   | 0.815       |  | 0.770       |  |            |  |            |  |  |  |
| CR5   | 0.879       |  | 0.847       |  |            |  |            |  |  |  |
| Information Sharing (IS) (Cronbach's alpha $\alpha = 0.873$ )             |             |  |             |  |            |  |            |  |  |  |
| IS1   | 0.834       |  | 0.821       |  |            |  |            |  |  |  |
| IS2   | 0.816       |  | 0.788       |  |            |  |            |  |  |  |
| IS3   | 0.688       |  | 0.606       |  | 0.543      |  | 0.876      |  |  |  |
| IS4   | 0.801       |  | 0.768       |  |            |  |            |  |  |  |
| IS5   | 0.798       |  | 0.734       |  |            |  |            |  |  |  |
| IS6   | 0.762       |  | 0.682       |  |            |  |            |  |  |  |
| Information Quality (IQ) (Cronbach's alpha $\alpha = 0.819$ )             |             |  |             |  |            |  |            |  |  |  |
| IQ1   | 0.782       |  | 0.736       |  |            |  |            |  |  |  |
| IQ2   | 0.884       |  | 0.928       |  | 0.766      |  | 0.942      |  |  |  |
| IQ3   | 0.797       |  | 0.662       |  |            |  |            |  |  |  |
| IQ4   | 0.751       |  | 0.587       |  |            |  |            |  |  |  |

Note: EFA-Exploratory factor analysis; CFA-Confirmatory factor analysis; AVE-Average variance extracted; CR'-Construct Reliability.

Table 10. Validity Measures for SCMP

|     | $\alpha$ | CR'   | AVE   | MSV   | ASV   | IS    | SSP   | IQ    | CR    |
|-----|----------|-------|-------|-------|-------|-------|-------|-------|-------|
| IS  | 0.873    | 0.876 | 0.543 | 0.010 | 0.004 | 0.737 |       |       |       |
| SSP | 0.902    | 0.903 | 0.608 | 0.010 | 0.004 | 0.102 | 0.780 |       |       |
| IQ  | 0.819    | 0.942 | 0.766 | 0.006 | 0.002 | 0.010 | 0.012 | 0.875 |       |
| CR  | 0.938    | 0.810 | 0.533 | 0.006 | 0.002 | 0.008 | 0.009 | 0.080 | 0.730 |

Note:  $\alpha$ - Cronbach's alpha, CR'-Construct Reliability, AVE-Average Variance Extracted, MSV-Maximum Shared variance, ASV-Average Shared Squared Variance, IS-Level of Information Sharing, SSP-Strategic Supplier Partnership, IQ-Level of Information Sharing, CR-Customer Relations

Table 11. Final results of Exploratory Factor Analysis for PPERF

| Variable        |  | Factor 1 | Factor 2 | Factor 3 | Factor 4 |
|-----------------|--|----------|----------|----------|----------|
| <b>Factor 1</b> | <b>Quality</b>   |          |          |          |          |
| Q3              | Focusing on product design   | 0.989    |          |          |          |
| Q4              | Product made to specifications (Conformance quality)                       | 0.987    |          |          |          |
| Q5              | Damages/defects  | 0.990    |          |          |          |
| Q6              | Basic characteristics of the product are good (Performance quality)        | 0.994    |          |          |          |
| Q7              | Quality of raw material is good  | 0.956    |          |          |          |
| Q8              | Workers skills & efficiency is up to the mark in processing                | 0.966    |          |          |          |
| <b>Factor 2</b> | <b>Flexibility</b>   |          |          |          |          |
| F1              | Mix flexibility (Ability to produce wide range of products)                |          | 0.908    |          |          |
| F2              | Volume flexibility (Ability to produce whatever volume the customer needs) |          | 0.874    |          |          |
| F3              | Product variety  |          | 0.907    |          |          |
| <b>Factor 3</b> | <b>Delivery</b>  |          |          |          |          |
| D1              | On-time delivery   |          |          | 0.918    |          |
| D2              | Lead-time  |          |          | 0.849    |          |
| D3              | Delivery Speed   |          |          | 0.898    |          |
| <b>Factor 4</b> | <b>Cost</b>  |          |          |          |          |
| C1              | Raw material cost  |          |          |          | 0.896    |
| C2              | Labour cost  |          |          |          | 0.908    |

Table 12. Model fit summary for PPERF

|          |    | Absolute fit indices |       |       | Parsimony fit indices |       | Incremental fit indices |       |       |       |
|----------|----|----------------------|-------|-------|-----------------------|-------|-------------------------|-------|-------|-------|
| $\chi^2$ | df | $\chi^2/df$          | GFI   | RMSEA | AGFI                  | PNFI  | NFI                     | TLI   | CFI   | RFI   |
| 181.046  | 69 | 2.624                | 0.936 | 0.067 | 0.903                 | 0.743 | 0.980                   | 0.984 | 0.988 | 0.974 |

Table 13. Reliability of PPERF

| Factor   | EFA Loading |       | CFA Loading |  | AVE(>0.5) | CR'(>0.7) |       |  |
|--|-------------|-------|-------------|--|-----------|-----------|-------|--|
| Quality (Q) (Cronbach's alpha $\alpha = 0.989$ )     |             |       |             |  |           |           |       |  |
| Q3   |             | 0.989 | 0.993       |  |           |           |       |  |
| Q4   |             | 0.987 | 0.992       |  |           |           |       |  |
| Q5   |             | 0.990 | 0.994       |  | 0.950     |           | 0.991 |  |
| Q6   |             | 0.994 | 0.999       |  |           |           |       |  |
| Q7   |             | 0.956 | 0.927       |  |           |           |       |  |
| Q8   |             | 0.966 | 0.942       |  |           |           |       |  |
| Flexibility (F) (Cronbach's alpha $\alpha = 0.942$ ) |             |       |             |  |           |           |       |  |
| F1   |             | 0.908 | 0.967       |  |           |           |       |  |
| F2   |             | 0.874 | 0.851       |  | 0.851     |           | 0.945 |  |
| F3   |             | 0.907 | 0.946       |  |           |           |       |  |
| Delivery (D) (Cronbach's alpha $\alpha = 0.935$ )    |             |       |             |  |           |           |       |  |
| D1   |             | 0.898 | 0.947       |  |           |           |       |  |
| D2   |             | 0.918 | 0.826       |  | 0.835     |           | 0.938 |  |
| D3   |             | 0.849 | 0.962       |  |           |           |       |  |
| Cost (C) (Cronbach's alpha $\alpha = 0.887$ )        |             |       |             |  |           |           |       |  |
| C1   |             | 0.896 | 0.925       |  | 0.800     |           | 0.889 |  |
| C2   |             | 0.908 | 0.863       |  |           |           |       |  |

Note: AVE = Average Variance Extracted, CR' = Construct Reliability

Table 14. Validity Measures for PPERF

|             | $\alpha$ | CR'   | AVE   | MSV   | ASV   | Delivery | Quality | Flexibility | Cost  |
|-------------|----------|-------|-------|-------|-------|----------|---------|-------------|-------|
| Delivery    | 0.935    | 0.938 | 0.835 | 0.324 | 0.180 | 0.914    |         |             |       |
| Quality     | 0.989    | 0.991 | 0.950 | 0.004 | 0.001 | 0.013    | 0.975   |             |       |
| Flexibility | 0.942    | 0.945 | 0.851 | 0.324 | 0.176 | 0.569    | 0.004   | 0.923       |       |
| Cost        | 0.887    | 0.889 | 0.800 | 0.216 | 0.141 | 0.465    | 0.062   | 0.452       | 0.895 |

Note:  $\alpha$ -Cronbach's alpha, CR'-Construct Reliability, AVE-Average Variance Extracted, MSV-Maximum Shared variance, ASV-Average Shared Squared Variance.

Figure 6. The structural model for Supply Chain Management Practices and Production Performance

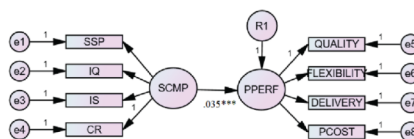


Table 15. Model Fit for SCMP-PPERF

|            | $\chi^2/df$ | GFI   | AGFI  | RMSEA | NFI   | TLI   | CFI   | RFI   | PNFI  | PGFI  |
|------------|-------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| SCMP→PPERF | 3.030       | 0.979 | 0.947 | 0.079 | 0.973 | 0.969 | 0.979 | 0.959 | 0.648 | 0.932 |

Note:  $\chi^2$  /df-degrees of freedom, GFI-Goodness of fit; AGFI-Adjusted goodness of fit; RMSEA-Root mean square error of approximation; NFI-Normed fit index; TLI-Tucker-Lewis index; CFI-Comparative fit index; RFI-Relative fit index; PNFI-Parsimonious normed fit index; & PGFI-Parsimony goodness of fit index.

Table 16. Result of hypothesis based on SEM

|      |   |       | Estimate | P   |
|------|---|-------|----------|-----|
| SCMP | → | PPERF | 0.035    | *** |

If any further study has to be carried on this topic, one can think of using system dynamics. As cited by Gafi & Javadian (2018), there are several reasons that make system dynamics System dynamics as a good methodology for modeling of the supply chains: first, the ability to understand the system as a whole, then analyzing the interactions between the various components of the integrated system and finally supplying feedback without decomposing (Özbayrak et al., 2007).



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